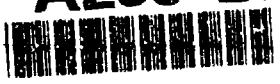

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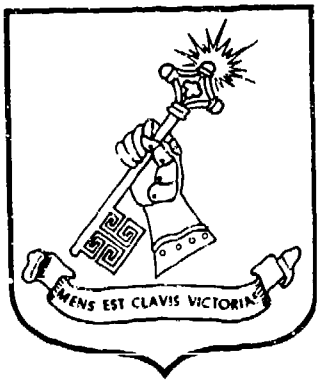
Smart Weapons–
Can We Fold The Nuclear Umbrella?

A Monograph
by
Major Robert H. Vokac
Field Artillery



School of Advanced Military Studies
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Fort Leavenworth, Kansas

First Term AY 91–92

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	17/12/91	MONOGRAPH

4. TITLE AND SUBTITLE
SMART WEAPONS - CAN WE FOLD THE NUCLEAR UMBRELLA? (U)

5. FUNDING NUMBERS

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
SCHOOL OF ADVANCED MILITARY STUDIES
ATTN: ATZL-SWV
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COM (913) 684-3437 AUTOVON 552-3437

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
~~SEE ATTACHED~~

14. SUBJECT TERMS
TACTICAL NUCLEAR WEAPONS CORPS FIREPOWER
SMART WEAPONS
PRECISION GUIDED MUNITIONS

15. NUMBER OF PAGES
50

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

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Title of Monograph: Smart Weapons -
Can We Fold The Nuclear Umbrella?

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Accepted this 31st day of December 1991

ABSTRACT

SMART WEAPONS - CAN WE FOLD THE NUCLEAR UMBRELLA?, by Major Robert H. Vokac, USA, 50 pages.

The United States has possessed smart weapons since the late 1960's. Each generation of smart weapons incorporated significant improvements in range, accuracy, and lethality over the previous generation. These continuing improvements led many military analysts to question the continued utility of Army tactical nuclear weapons. With the elimination of Army tactical nuclear weapons, the Army must assess if the effectiveness of smart weapons eliminates the need for Army tactical nuclear weapons.

Following a discussion of the evolution of tactical nuclear weapons and smart weapons theories, capabilities, and employment doctrines, this monograph conducts a comparative analysis of tactical nuclear weapons and smart weapons. This analysis suggests that a "conventional only" Army is acceptable because of a changing world threat environment, sophistication of available smart weapons, the continuing availability of tactical nuclear weapons from the Air Force and Navy, and the political, moral, and military costs of maintaining a system never employed in combat. While tactical nuclear weapons were weapons of last resort, smart weapons can be weapons of first resort.

Table of Contents

INTRODUCTION

Smart Weapons -

Can We Fold the Nuclear Umbrella?

> New weapon technologies are frequently expected to perform a number of functions. New weapons which fly faster, dive deeper, or shoot more accurately are purported to possess great powers far beyond their technical characteristics. They are credited with being able to cause a reorganization of military forces, or change the manner in which warfare is fought, or preclude warfare altogether But, technology does not do these things, states do.[1]

President George Bush's stunning announcement of 27 September 1991 marked perhaps the most fateful day in the almost 40 year history of tactical nuclear weapons (TNW). On that day, the President ordered the elimination of ground-launched tactical nuclear weapons. This order effectively created a "nuclear-free" army, armed entirely with conventional weapons, for the first time since 1954.

A Pentagon press conference conducted 28 September 1991 by Mr. Dick Cheney, Secretary of Defense, and General Colin Powell, Chairman of the Joint Chiefs of Staff, revealed ". . . we will destroy approximately 1,300 cannon-fired projectiles of three different types - two eight-inch howitzer types and one 155 mm type. We will also destroy 850 Lance missile warheads."[2] The Army immediately initiated actions to comply with this sweeping directive.

General Powell, asked about the implications of

these reductions, answered in part,

> The increased capability associated with conventional weaponry in recent years has inclined us to getting rid of tactical nuclear weapons. We can now do conventionally much more efficiently things we thought we could only do with tactical nuclear weapons.[3]

Conventional weapons, long thought technologically inferior to nuclear weapons, moved to the forefront of military technology.

The research question for this monograph is to determine if the effectiveness of smart weapons (SW) eliminates the battlefield need for Army tactical nuclear weapons. This issue, not designed to challenge the wisdom of national policy, is relevant for corps operations since the loss of Army nuclear weapons represents a significant degradation of potential firepower. Examination of the issue requires an understanding of TNW and smart weapons theories, doctrines, and capabilities. Building upon this background information, I will then evaluate nuclear weapons and smart weapons against the criteria of battlefield effectiveness, cost, collateral damage, threat, reliability, and nuclear threshold.

Force structure changes carry significant implications within our dynamic world environment. As the Army grows numerically smaller it must qualitatively improve. Our available combat systems must achieve maximum effectiveness in firepower,

lethality, range, and accuracy.

"Optional" wars, such as Desert Storm (1991), represent a unique application of national power. These conflicts are "optional" in that participation of the United States is not required by formal treaty or alliance to intervene. While "optional" wars will normally reflect a favorable ratio of United States combat power, the Army must be prepared to operate all across the continuum of operations.

Our recent experiences with Operations Just Cause and Desert Shield/Storm have conditioned the American public to expect quick, decisive victories with minimum loss of American life. We must employ military force consistent with military requirements without applying excessive force or firepower. Public opinion, both home and abroad, expects the United States to exercise restraint in the pursuit of military objectives. Weapons, particularly those employed in coalition warfare, must be acceptable to all coalition members. This required consensus will potentially limit the available military options.

The Army faces a variety of threats throughout the world. Of particular concern are regional threats such as those initiated by Iraq in 1990. The rapid proliferation of advanced weaponry has increased the sophistication and danger posed by regional threats.[4]

While the reduction of tensions with the Soviet Union has lowered the imminent prospect of global nuclear war, it has not yet reduced the proliferation of nuclear technology. Within six to 10 years an estimated 25 countries will have nuclear weapons.[5] Nations such as India, Iran, Iraq, Israel, North Korea, Pakistan, and South Africa either possess or will possess nuclear technology in the near term. All of these nations are significant regional powers. Nations, such as Iraq, may employ or threaten the use of nuclear weapons to gain a regional advantage. The United States may face a future opponent that is well-equipped, well-armed, and well-trained.

TNW were first developed in the United States. The term "tactical nuclear weapons" best refers to

> battlefield nuclear weapons, for battlefield use, and with deployment, ranges, and yields consistent with such use and confined essentially in each respect to the area of localized military operations.[6]

Within the current Army inventory, now being withdrawn, this definition encompasses tactical nuclear warheads for the 155 mm howitzers, eight-inch howitzer, and the Lance missile. These systems, spanning the W48 warhead first produced in 1963 for the 155 mm howitzer to the W79 warhead last produced in 1986 for the eight-inch howitzer, represent the spectrum of Army nuclear capable delivery systems normally available to a corps commander.

Additional tactical nuclear weapons may be available within theater. Air Force and Navy tactical nuclear weapons, consisting of gravity bombs, are also available for a corps commander. These assets, if released by the National Command Authority (NCA), can support theater requirements, not simply the Army component.

Smart weapons, consisting of guided munitions, smart munitions, and brilliant munitions, encompass a growing family of weapon systems. For purposes of clarity the following description should suffice:

> Smart weapons are distinguished from other types of weapons in that they are capable of performing their missions with varying degrees of autonomy. The mission of a smart weapon is to search for, detect, discriminate, select, and engage ground targets or close air support, fixed-wing aircraft and helicopters.[7]

They ". . . provide significant improvements in range, accuracy, and lethality compared to unguided systems. They also allow increased engagement rates, and they can be employed to selectively attack specific types or classes of targets."[8] The specific smart weapons available to a corps commander will be examined in detail later in the paper.

THEORY FOR ARMY TACTICAL NUCLEAR AND SMART WEAPONS

Army tactical nuclear weapons theory was originally developed in the early 1950's. The Korean War, a long and bloody stalemate, accelerated the impetus to integrate high technology weaponry with a

military strategy.[9] As early as March 1951, a Johns Hopkins University research group reported to General Douglas McArthur that the Korean War offered an opportunity to study the tactical employment of atomic bombs.[10]

> For its part, the Army concluded on July 5, 1951, that using nuclear weapons to "increase our efficiency of killing" was necessary to break the Korea deadlock in Korea and recommended field tests to develop a doctrine for battlefield use.[11]

Eight short years after the decisive victories of World War Two, America was thoroughly frustrated by her inability to gain battlefield victory. Perhaps nuclear technology, combined with a viable nuclear theory, could provide a solution.

The Army struggled with nuclear theory from the end of World War Two through the conclusion of the Korean conflict. Army leadership, led by successive Chiefs of Staff Eisenhower, Bradley, and Collins, worked to justify a requirement for Army nuclear weapons. Eventually, fueled by a 1950 European battlefield analysis conducted at Fort Leavenworth, the Army created a requirement based on the need to control its battlefield destiny.[12]

The Army intended to pursue an independent nuclear capability. To support this requirement, the Army designed a nuclear artillery shell for the 280 mm artillery cannon and developed the Army's first

surface-to-surface missile, the Corporal. Both systems were operational by 1953.[13]

The election of President Eisenhower in November 1952 provided an additional impetus for theoretical development. President Eisenhower's "New Look", approved in October 1953, established the primacy of nuclear deterrence over conventional warfighting.[14] This concept, further reinforced by the "Massive Retaliation" policy decision of 1954, enhanced the need for tactical nuclear weapons theory. The Army, relegated to a supporting role in national defense policy, desperately sought a viable nuclear role.

Firepower, in the form of tactical and strategic nuclear fires, would substitute for manpower for the "New Look" Army. Under "New Look", the United States could be spared the embarrassment of a "limited war" fought to a draw if nuclear weapons were used. Nuclear technology appeared to offer the means for rapid and decisive battlefield victory. Properly applied, nuclear technology could perhaps eliminate war altogether.[15]

As a result of the "New Look" concept, the President directed the military to base planning on the use of nuclear weapons when the military situation required.[16] The President's emphasis on nuclear weapons provided one opportunity to address pressing alliance problems in Europe and represented an

interesting personal reversal. As Supreme Allied Commander Europe (SACEUR), then General Eisenhower advocated conventional deterrence which ultimately led to the 1952 Lisbon Conference's call for 90 divisions to guarantee Western European security against the Soviet threat. Eisenhower, later as President, recognized this exceeded the existing economic, political, and military capabilities of the United States and her allies.

The European allies, still exhausted by World War II, yet fearful of the Soviet threat, needed a practical response to the perceived Soviet conventional superiority. President Eisenhower's offer to deploy nuclear weapons to Europe was accepted by North Atlantic Treaty Organization (NATO) member states as a cost saving alternative to maintaining large levels of forces. During 1953 - 54, the United States deployed 7,000 nuclear warheads to Europe.[17]

Advocates of tactical nuclear weapons emphasized benefits in decreased logistics requirements, decreased manpower requirements, and economic benefits related to the availability of a larger civilian work force as a result of decreased military manpower requirements. Critics argued manpower requirements in war would increase due to casualties, extensive damage would result from the nuclear detonations, and long-term effects would cause

significant political difficulties.[18]

Nuclear theory developed during the Eisenhower administration ultimately provided limited military utility due to its all or nothing approach. A credible conventional force for operations short of nuclear war did not exist. Army leaders, such as then Chief of Staff Matthew Ridgway, decried the loss of conventional capabilities. The 1954 version of FM 100-5, Operations, maintained the Army's focus on conventional operations while recognizing the potential employment of nuclear weapons. The significant political role of nuclear weapons appeared to reduce the traditional role played by military leadership in determining how to best employ their forces in support of national objectives.

Tactical nuclear weapons provided a deterrent to Soviet adventurism in Western Europe. All Soviet actions would require a careful consideration of a possible NATO nuclear response. The American guarantee provided a presumed linkage to our own strategic nuclear forces, thus providing a degree of security for our European allies. However, the development of Soviet tactical and strategic nuclear capabilities, particularly the ability of Soviet strategic forces to strike the United States, created new complications. European allies wondered if the United States would continue to provide an unequivocal

nuclear guarantee for Europe if this could lead to a Soviet nuclear strike against the United States.

The election of President Kennedy in 1960 produced an increased emphasis on conventional forces concurrent with continued modernization of tactical nuclear forces. By the mid-1960's,

> feeling confined by what it viewed as the previous "all or nothing" policy and fearing the effects of a Soviet response to an American fulfillment of its strategic pledge of support to NATO, the United States had pushed instead for a NATO strategy which included "more options".[19]

Options desired by the United States included an enhanced conventional force capability to increase the nuclear threshold. NATO allies were not receptive to this proposal as it appeared to increase their risk by distancing the American nuclear guarantee.

By the end of the 1960's, driven by a hardware and software evolutionary process, precision-guided munitions (PGM) technology first appeared.

> Relatively inexpensive, very accurate, and non-nuclear, precision guided munitions appeared able to provide cheaply firepower that was well below the "threshold" of nuclear weapons, and allow the defeat of a superior Soviet force.[20]

The NATO policy of "flexible response", approved in 1967, was an outgrowth of the desire to create "more options". As a deterrent strategy, "flexible response" relied upon conventional forces, theater nuclear, and strategic nuclear forces. The advent of precision-guided munitions added credence to the

capabilities and deterrent values of conventional forces.

Precision-guided munitions were not developed in direct response to NATO conventional force shortfalls. They reflected an evolutionary technology which appeared at the right time. The United States, recognizing the potential of this emerging technology, pushed it on somewhat reluctant allies to improve conventional force capabilities. A theory of conventional deterrence now evolved. The new systems did provide enhanced capabilities.

Precision-guided munitions generally refer to a ". . . bomb or missile that is guided during its terminal phase. . . ."[21] In most cases, the expectation of making a direct hit at maximum effective range is greater than 50%.[22] Early surface-to-surface systems, such as the TOW, had ranges less than 3,000 meters thus reducing their battlefield utility. Laser-guided bombs, another precision munition, were first used in Vietnam. The targeting accuracy of laser-guided bombs, generally around 80%, validated the economic and operational viability of the new technology.[23]

The employment theory of these weapons integrated military and political considerations. Developed as a response to manpower inadequacies, technological availability, political sensitivities, and an ex sting

threat, ". . . precision-guided munitions were proclaimed to be able to provide NATO with the superior firepower which would enable it to defeat the vastly superior Warsaw Pact Treaty Organization."[24] This theory proved acceptable to the United States, but European dissenters perceived no lessening of the nuclear threat. Today's employment theory continues to integrate military requirements with political realities. Smart weapons theory envisions continued technological improvements gradually reducing manpower requirements yet enhancing overall force capabilities.

Prominent early theorists such as James Digby, then a senior staff member at the Rand Corporation, envisioned an increase in range, accuracy, effectiveness, and lethality.[25] "This in turn would save time -- allow many more targets to be defeated in a shorter period of time -- and allow an equal number of delivery systems to attack many more targets."[26] Ultimately the incorporation of new systems, such as the Army Tactical Missile System (ATACMS) equipped with smart munitions, will provide the means to mass lethal fires at far greater ranges than ever before.

> In summary, the theoretical advantages of smart weapons are their ability to change the dimensions of the battlefield in terms of both space -- laterally and in depth -- and time, allowing US forces to better mass lethal antiarmor fires in support of US operations in the close and deep battles, disrupting and delay enemy operations, and synergistically enhance the effectiveness of US maneuver/close battle forces.[27]

Theory for tactical nuclear weapons and smart weapons evolved with a European (NATO) focus. Western Europe, faced with the most dangerous, if not always the most likely threat, dominated military and associated political thought during the Cold War. Future theories must adequately address any expected battlefield environment.

TACTICAL NUCLEAR WEAPONS

Tactical nuclear weapons are unique. No other weapon, with the possible exception of fuel-air explosives, contains their destructive power. However, as a weapon of mass destruction, they present unique doctrinal problems. Doctrine must address not only their military utility, but their political and moral impact as well.

FM 100-5, Operations, the Army's keystone warfighting manual, provides current guidance on nuclear doctrine.

> Even though the primary purpose of nuclear weapons is to deter their use by others, the threat of nuclear escalation pervades any military operation involving the armies of nuclear powers, imposing limitations on the scope and objectives even of conventional operations.[28]

This statement suggests a policy of non-use though the United States has not renounced the right of first use. This doctrinal statement from FM 100-5 recognizes a doctrine of deterrence, not necessarily a viable nuclear warfighting doctrine.

FM 100-5 lists enemy nuclear delivery systems, key command and control elements, support forces in the rear of committed elements, follow-on or deep-echeloned forces, and reserves as preferred nuclear targets.[29] "Even after authority is granted for employment of nuclear weapons, employment will be guided by strategic purposes more than by tactical effect."[30] To achieve the desired strategic effects, constant refinement of nuclear packages is required. "Release will be predicated on a high confidence that the effects achieved will be precisely those intended - no more, no less."[31] FM 100-5 appears to suggest that even after nuclear release, little flexibility exists at corps level for integration of nuclear and conventional fires. More importantly, does this doctrine describe an asset we will use in war?

FM 101-31-1, Nuclear Weapons Employment Doctrine and Procedures, provides additional doctrinal guidance. This manual stresses the integration of conventional and nuclear fires "to alter the course of the battle positively and persuasively, to preclude the enemy's achieving its objective, and to ensure the success of the attack by US, NATO, or allied forces."[32] Use of nuclear weapons ". . . is closely controlled and likely to be limited in an attempt to reduce the risks of escalation."[33] Nuclear weapons

employment ". . . at the corps level is explicitly intended to influence an operational decision on the battlefield."[34] FM 101-31-1 recognizes the significant political aspects of tactical nuclear weapons yet provides a planning methodology for use by a corps commander and his staff.

Four considerations determine the suitability of nuclear fires on the battlefield. First, the relative effectiveness of nuclear versus conventional weapons must be assessed. Nuclear fires must produce a significant gain in tactical effectiveness, otherwise an important asset is wasted.

Second, collateral risks must be recognized. Risks include those to friendly troops, civilians, and the anticipated enemy response. Operations on a nuclear battlefield are significantly complicated through the creation of obstacles inhibiting friendly movement. Political risks, particularly those generated through tactical nuclear weapons employment in host nations, must be carefully considered.

Third, the potential enemy response must be assessed. What are the implications of first use by US forces against a similarly equipped enemy? Can we assume the enemy views use of tactical nuclear weapons as a means of escalation control? Can we afford to employ tactical nuclear weapons against an enemy not so equipped? For example, during Desert Shield, a

theory posited nuclear weapons might be required to safely withdraw our initial "trip-wire" force if threatened with defeat. The global political costs of such an action, even when clearly supporting a defined military objective, could prove insurmountable.

Fourth, effective planning is essential. Planning must be integrated into all operational planning. Anticipation is critical. Planning must constantly analyze those targets offering the highest payoff. Additionally, planners must factor in delays in both release and impact on friendly operations.[35]

FM 100-15, Corps Operations, provides further doctrinal guidance. FM 100-15 recognizes "political and strategic objectives rather than tactical effect will likely guide the employment of nuclear weapons."[36] Nuclear weapons will be employed by the corps to achieve operational and tactical objectives in support of a campaign plan. Corps nuclear operations will be used to attack the enemy center of gravity or to force him to prematurely realize his culminating point.[37]

FM 100-15 envisions employing corps nuclear weapons for six specific functions. These weapons could be used to accomplish the following:

> create gaps in enemy defenses to support offensive maneuver, destroy second echelons of enemy forces engaged with corps combat elements, interdict enemy follow-on forces or formations in depth, support denial operations, destroy the

> enemy's nuclear and chemical capabilities, and destroy the enemy's support capability.[38]

The employment doctrine at corps envisions a tactical nuclear weapon battlefield role. This employment doctrine provides a foundation for the corps commander to shape the battlefield. Corps deep operations provide a point of focus.

"Air-delivered conventional, chemical, and tactical nuclear weapons; conventional, chemical, and tactical nuclear weapons delivered by cannon, rocket, or missile artillery; . . . are the primary weapons for deep operations."[39] Nuclear weapons in the deep operations role can

> create a window for future offensive action, destroy, slow or reduce follow-on forces, create the time and space for maneuver against attacking echelons, destroy high pay-off targets, force dispersal, create obstacles which canalize Threat forces[40] and destroy the Threat's staging areas.

While the employment options at corps level may appear obvious, problems exist in delivering nuclear weapons to the desired targets.

Delivery systems are limited by range or availability. Except for the Lance missile, with a nuclear capability in excess of 100 kilometers, the corps commander is limited to the short ranges of the 155 mm and eight inch systems. Neither system allows the corps commander to engage targets beyond 29 kilometers, severely limiting his capabilities. When

the corps operates in a joint environment, United States Air Force (USAF) or United States Navy (USN) assets may be available to deliver nuclear weapons. While many air delivered bombs have variable yields, thus making them suitable for generally low yield Army requirements, their use must be balanced against requirements elsewhere in theater. The continuing development of airland operations and joint doctrine must encompass tactical nuclear employment doctrine.

Nuclear weapons must be employed with full knowledge of their effects. Their effects are unlike any other weapon available to the corps commander. Blast, radiation, heat, and electromagnetic pulse (EMP) can destroy or neutralize targets.[41] The corps commander will integrate these effects, further described below, into his offensive or defensive plan attempting to achieve the desired target effects while minimizing collateral damage.

Blast causes the majority of material damage.[42] Blast, carrying approximately half the weapon's total energy, varies based upon the location of the burst. An air burst, normally the preferred technique, will optimize blast effects and reduce the militarily significant fallout.[43] The high winds and atmospheric pressure changes are responsible for producing the blast effects.

Nuclear radiation represents approximately one

third of the weapon's total energy. "Thermal radiation causes burns, fires, and flash blindness."[44] Radiation will occur within one minute of the detonation with residual radiation following for hours, days, or weeks. Radiation has its greatest effect against personnel, but it can damage materiel. "Residual radiation may be a lingering and widespread operational hazard."[45] While blast and thermal effects are finite, radiation has the tendency to create long-term effects which significantly impact on both friendly and enemy operations.

The thermal, or heat, effects of a nuclear blast represent the remaining one third of the weapon's energy. The heat flash has minimal effects against dispersed military targets, such as armored vehicles, but is devastating against personnel in the open. The thermal effects may cause fires, thus increasing the devastation within the target area.

Electromagnetic pulse represents the fourth effect of nuclear weapons. It is best described as

> a burst of intense radiation covering the frequency spectrum up to several hundred megahertz and inducing very high currents and voltages in cabling and metal structures. Power lines, telephone cables, TV and radio, computers - in fact anything connected to a power line or antenna, would burn out and impart a severe shock to anyone in contact with the collector.[46]

While the actual effects are temporary, the damage

caused may be temporary or long-term. Electromagnetic pulse causes the greatest difficulties for C^3 planners.

The reader now has a basic understanding of tactical nuclear weapons employment doctrine and the effects created by use of nuclear weapons. Now, perhaps, is an appropriate time to address a critical question. Do tactical nuclear weapons really provide a significant advantage for the using commander? As might be expected, opinions vary widely.

General Frederick J. Kroesen, USA (Ret), a former USAREUR Commander, representing one end of the spectrum, writes, "they are a military tool, more efficient and more lethal than any other weapon employed throughout military history."[47] This viewpoint represents recognition of the tremendous firepower available through use of tactical nuclear weapons. FM 100-15, addressing the combat dynamic of firepower concludes:

> If the corps intent is to destroy the enemy force, then it must achieve overwhelming combat power against that force. However, in most instances, the element (dynamic) of firepower will be the limiting factor, and sufficient firepower will only be available to destroy a part of the enemy to cause its eventual defeat.[48]

Firepower alone may constitute a significant advantage for the using commander.

Others would argue use of tactical nuclear weapons provides no significant advantage, particularly

against an enemy with like capabilities. They may provide a temporary tactical advantage which would rapidly disappear with escalatory responses. FM 100-30, Nuclear Operations in Support of Airland Operations (Final Draft), perhaps provides the most realistic view:

> Nuclear weapons are highly destructive and have harmful effects (thermal, EMP, radiation and blast) that other weapons do not have. However, their use will not prove to be decisive per se. They can make a major contribution to operations but only if the commander uses these very destructive weapons as part of a well thought-out plan employing a range of firepower and other resources, including the intangible resources of leadership, intelligence, and courage.[49]

Once the nuclear threshold is crossed, of what real significance are tactical nuclear weapons? The best use of nuclear weapons is one of deterrence. Actual use implies the loss of deterrence. Therefore, their real value may be lost after first use.

Many costs are associated with tactical nuclear weapons. Blast, thermal, radiation, and EMP effects radically transform the battlefield impacting on civilian and military lives and property. While it is impossible to estimate the dollar cost involved in the maintenance of this capability, there are certain tangible costs associated with their availability.

The annual costs of developing, purchasing, and maintaining nuclear weapons, exercising their command and control, and training crews must be

significant.[50] Nuclear weapons require a separate infrastructure.

> Commanders of delivery units must ensure that all supporting activities - target acquisition, special ammunition distribution, nuclear control personnel and equipment, and operational security - are maintained continuously in a high state of readiness to execute on relatively short notice.[51]

As Harry Summers pointed out in a recent article,

> A sure way to get relieved from command and permanently ruin your military career was failure to rigorously follow the detailed rules and regulations for safeguarding those [nuclear] weapons, including the strict guidelines on who could have access.[52]

In short, maintenance of a tactical nuclear weapons capability presents a true "zero defects" situation. For the dual-capable (nuclear and conventional mission) delivery units, the time spent training on nuclear tasks detracted from conventional training. Yet, given the "zero defects" requirements of the nuclear world, there was no choice.

SMART WEAPONS

Smart weapons are touted as high technology weapons and munitions which have reduced the need for TNW by raising the nuclear threshold. In fact,

> for over a decade, the United States and NATO policy communities have focused on advanced conventional munitions (ACMs), a group of indirect fire, fire-and-forget, many-on-many smart weapons, as one high-technology solution to the East-West conventional imbalance and declining nuclear stockpiles.[53]

Precision-guided munitions ushered in the era of smart

weapons.

Military and political optimists hoped precision-guided munitions would provide a sufficient technological advantage over superior Soviet and Warsaw Pact materiel resources, particularly armor, to raise the nuclear threshold. What exactly did precision-guided munitions technology offer the alliance?

> Precision guided munitions seemed to possess all the benefits that the previous new weapon technologies did not. Unlike tactical nuclear weapons, precision weaponry did not cause vast amounts of collateral damage when used. They did not possess radioactive components and therefore did not pose a health hazard to non-combatants many miles from the battle area. Although they were a new form of weaponry, there did not immediately develop a tradition of non-use, as has occurred with tactical nuclear weapons and biological agents.[54]

These new weapons, politically acceptable, offered the potential to place usable military technology in the hands of military commanders.

The 1973 Arab - Israeli War had profound effect on the integration of precision-guided munitions technology with conventional forces. Military observers were astounded at the lethality of this high-intensity, conventional conflict. Doctrinal development essentially ignored the nuclear battlefield attempting to find solutions to the lethal battlefield. The authors of the 1976 version of FM 100-5 focused their attention on the ". . . prompt,

effective application of conventionally-armed forces. . ."[55] based on their perceived requirements of the modern battlefield.

The 1973 War provided mixed reviews for the new technology. Precision-guided munitions, specifically anti-tank systems, played initial havoc with Israeli armor. Eventually, the Israeli's developed countertactics greatly reducing PGM effectiveness. Battle Damage Assessments (BDA) conducted after the war revealed many precision-guided munitions "kills" hit static vehicles already immobilized by other weapons.[56] Though the technology offered accurate fires and the potential to alter the course of battle, they were generally less effective than expected.[57]

The 1982 Israeli incursion into Lebanon and the Falklands War provided yet another precision-guided munitions laboratory. Israel found the TOW extremely effective due to significant improvements in tracking technology.[58] The Falklands War provided insights into air-delivered PGM technology. The British reported three-meter accuracy with laser-guided bombs.[59] For both belligerents ". . ., the attack experience on both sides strongly encourages the use of precision-guided munitions such as the Maverick (laser-guided, TV-guided, or IR version) or submunitions dispensers in standoff delivery systems."[60]

The follow on forces attack (FOFA) strategy postulated by NATO in the early 1980's was a direct result of advances in conventional technology. In concept,

> the general idea of the plan is to stop the first echelon of the Soviet attack with NATO ground forces, and to simultaneously launch air attacks using large numbers of precision-guided munitions against the second and third echelons of the Soviet forces to prevent them from coming to the support of the first echelon.[61]

Interestingly, General Bernard W. Rogers, then SACEUR and architect of the FOFA strategy, wrote "this [FOFA] in turn will reduce - but not eliminate - our reliance upon a possible nuclear response."[62] This concept, central in other writings and studies, viewed smart weapons as an enhancement of conventional capabilities, not a replacement for tactical nuclear weapons. While smart weapons had the capability to replace nuclear weapons in selected missions, they could not replace the deterrent value of tactical nuclear weapons.

Smart weapons, in a NATO context, conformed to then existing political views. While certain NATO political leadership questioned the utility of a FOFA strategy in a "defensive" alliance, it was difficult to argue against the attractiveness of this option. Smart weapons allowed the best of both worlds by allowing the war to be fought at a long distance without the need to resort to nuclear weapons. The

option appeared feasible and painless compared to the cost of employing nuclear weapons in NATO territory.[63]

Smart weapons exist throughout a corps. A brief discussion of the three classes of smart weapons will provide an appreciation of the available systems, employment concepts, and future technologies.

Guided munitions include the TOW, Dragon, Hellfire and Copperhead.[64] An operator searches, locates, and guides the munition to impact. These munitions are considered "one-on-one" in that one munition engages one target. The positive operator control enables discrete target attack on a congested battlefield. These munitions allow the attack of critical targets, normally armor, with a relatively high probability of hit/kill. Guided munitions exist in great quantities throughout a corps.

"Smart munitions, such as sense and destroy armor (SADARM) and the Army Tactical Missile System (ATACMS) with Block II warhead, are current developmental examples and are generally employed as many-on-many weapons."[65] A smart munition, once launched, requires little or no operator involvement. "Two important advantages smart munitions have over guided munitions are their ability to perform autonomous target selection and their ability to attack multiple targets by employing submunitions."[66] The eventual

ability to strike moving, high pay-off targets during close and deep operations with smart munitions will enhance battlefield effectiveness.

"Brilliant munitions, currently in the notional [conceptual] state, will combine the autonomous operation of smart munitions with enhanced navigation and target classification and identification capabilities."[67] Brilliant munitions will attack specific classes or types of targets. Ultimately, brilliant munitions will allow a corps commander to significantly increase the depth and space of his area of operations (AO) without increasing human risk. For example, many deep operations may not require placing individual soldiers at risk.

Smart weapons technology is not the exclusive domain of the Army. Air-to-surface smart weapons impact significantly on joint operations. For example, the high speed anti-radiation (HARM) missile, delivered by USAF or USN attack platforms, is particularly effective against surface-to-air radar sites. The benefits are obvious during an air assault or deep operations conducted with aviation assets. The maverick air-to-ground missile, designed to destroy tanks and other armored vehicles, provides a significant enhancement to close air support or battlefield air interdiction. A corps must benefit from not only existing Army capabilities, but sister

service capabilities as well.

Operation Desert Storm in 1991 provided the services an outstanding opportunity to evaluate the capabilities and employment doctrine of smart weapons. Selected vignettes from Operation Desert Storm will provide insight into existing smart weapons capabilities throughout the armed forces.

"Precision-guided bombs and highly accurate cruise missiles allowed United States commanders to attack strategic targets, even in crowded urban areas like downtown Baghdad, without worrying too much about errant bombs killing civilians."[68] An article from Army Times, quoting an unidentified Army report stated:

> More than 30 [ATACMS] missiles were fired against surface-to-air missile sites, logistics sites, Scud positions, howitzer and rocket batteries and tactical bridges," the report says. Initial damage assessments indicated "ATACMS destroyed, or rendered inoperable, all of its targets," according to the report.[69]

Surface-to-surface systems such as ATACMS require an effective, real-time target acquisition capability. Without this capability, system effectiveness drops markedly.

General Charles A. Horner, writing in Military Review, writes,

> precision-guided munitions are essential to mission accomplishment with minimum collateral damage. It takes fewer sorties to destroy the target. This also reduces exposure and, therefore, reduces the potential for aircraft

losses.[70]

As almost any operation undertaken by the Army will be a joint operation, greater effectiveness of the air component should translate into greater effectiveness for the ground component.

A weapon of "mass destruction" is a label often applied to tactical nuclear weapons. In most cases this label is not appropriate for smart weapons due to their generally "limited" and "discrete" effects. This assessment recognizes smart weapons either "hit" or "miss" their target limiting effects to a finite time and space. However, regarding the Middle East, the following thought provides cause for reflection.

> Finally, other weapons can also cause the most serious damage in the region. Long-range missiles and aircraft with precision-guided warheads or highly lethal killing mechanisms like fuel-air explosives could often achieve the same lethality against fixed and highly sensitive targets like oil, power, desalinization and other water facilities, and communications targets. Careful selection of long-range precision killing mechanisms could well be as devastating - or prove to trigger massive conflicts - as the weapons of mass destruction.[71]

Perhaps smart weapons do have the capability to achieve "mass destruction" effects.

Smart weapons, like tactical nuclear weapons, were fielded to offset Soviet force superiority in Europe. Smart weapons incorporated technology to provide a qualitative edge over Warsaw Pact forces. This technology attempts to maximize firepower while

minimizing the logistics and manpower burdens. Most importantly, smart weapons provided the means to enhance the credibility of flexible response.

ANALYSIS

Recent policy decisions by President George Bush essentially ended much of the debate over tactical nuclear weapons and their proper role in United States military strategy. While tactical nuclear weapons remain part of our national arsenal, the Army's delivery role is ended. The elimination of the Army's nuclear weapons merely completes a process which appeared inevitable, particularly after cancellation of the Follow-on-to-Lance system in 1990 (driven by a general reduction in European tensions and NATO political misgivings), and the decision to retain the Multiple Launch Rocket System (MLRS) and ATACMS as conventional (non-nuclear) systems only.

Smart weapons represent the Army's future in weapons design. Technology, ever a driving force, will continue to improve the capabilities and usefulness of smart weapons. Our recent experience in Desert Storm provided a glimpse at the awesome technological abilities of smart weapons. Let's assess tactical nuclear weapons and smart weapons against various criteria and see where we stand.

Effects

A series of studies conducted for the Defense

Nuclear Agency (DNA) analyzed the effects of smart weapons and tactical nuclear weapons in a variety of combat simulations. Study results may reflect the pro-nuclear bias of this agency. DNA directed the studies in response to claims that smart weapons could do the same battlefield jobs as nuclear weapons.[72] These claims reflected the advances in sensor technology, development of subminiaturized computers, small guidance packages capable of seeking out targets, and a host of other significant advances in smart weapons technology.[73] All information presented represents unclassified extracts of the classified reports.

An SS-21 battalion, a Soviet surface-to-surface ballistic missile unit, consisting of 45 vehicles and 170 personnel located over a 50 square kilometer area provides our first target for analysis. All equipment and personnel are under tree cover. This low density target is difficult for both weapons. Smart weapons have difficulty locating targets under cover while multiple nuclear strikes are required to achieve a high probability of Transporter Erector Launcher (TEL) kills. Nuclear weapons provide greater effectiveness under the stated conditions.[74]

Our second case consists of four infantry companies with two companies under tree cover and two companies in the open. Nuclear weapons proved

effective achieving an over 40% not combat available (NCA) rate. Smart weapons proved ineffective against targets under tree cover and experienced a diminishing returns problem (chasing too many "dead" targets) with companies in the open thus requiring a large number of submunitions. Again, nuclear weapons appear to provide greater effectiveness.[75]

The third case consists of a combat vehicle column moving with a 50 meter interval between vehicles approximately six hours from contact. Vehicles are open and troops are unprotected. Smart weapons achieved approximately a 50% NCA rate utilizing ATACMS or air-to-surface munitions while nuclear weapons achieved approximately a 60% NCA rate using one warhead.[76] An interesting note appears with this study.

> It is apparent that the conventional attack and the nuclear attack produce quite different results over time; after the conventional attack the unit gradually regains capability, whereas after the nuclear attack the unit loses capability to a significant extent. An attack that at first glance seems to cause more destruction of combat capability with conventional weapons proves to be much less effective than the nuclear attack, if the effects are measured after five hours.[77]

This is explained by the general effects of each system. Smart weapons, oriented primarily against materiel, achieve a high immediate loss mitigated over time as crews repair damaged vehicles. Nuclear weapons, oriented against personnel, achieve a lower

initial loss rate, but one which increases over time as radiation casualties mount.[78]

Our fourth case consists of an armor attack formation moving and committed. Both systems proved effective against this target if a real-time aimpoint adjustment was made by a forward observer. The kill criteria in this case was based on the immediate effects of the attack, not the delayed effects as in case three.[79]

The fifth case studies smart weapons integration in a corps counterfire scenario. The study results, based on a standard NATO model, indicated United States forces enjoyed counterfire dominance through their use of 155 mm SADARM and MLRS SADARM.

> This allowed the US artillery to more rapidly win the counterfire battle, reduced the suppression of US direct fire systems, and allowed direct support artillery to devote more and more lethal fires to close support."[80]

Smart weapons, in adequate quantities, can help United States forces maximize the firepower of available weaponry.

Smart weapons appear more cost effective than tactical nuclear weapons when employed against hard point targets.[81] Smart weapons, as witnessed in Operation Desert Storm, have the capability to destroy hard point targets through their ability to attack specific weaknesses within a structure (air ventilator shaft, chimney, etc.). However, in the simulations

studied, tactical nuclear weapons proved more cost effective against large areas with numerous hard and soft targets.

Cost

Comparing the relative cost of each weapon must address issues other than absolute dollars. Tactical nuclear weapon costs are classified and a recitation of smart weapon costs would prove of no use to the reader. Perhaps our first cost criteria must deal with battlefield utility.

Harry Summers, writing in Army Times, states,

> What made it worse was a general conviction that those short-range nuclear artillery warheads were not worth the bother they caused, for it was hard to envision a scenario when they would actually be used, especially because they would provoke retaliation in kind.[82]

In short, the Army incurred a cost by creating a credibility crisis within the minds of its soldiers and leaders. Again, Mr. Summers writes,

> But if short-range nuclear artillery shells did us no good, they certainly did a great deal of damage. While United States artillerymen were fiddling away their time and money on nuclear munitions, the United States was being outgunned and outranged in conventional artillery.[83]

Storage, maintenance, and security of tactical nuclear weapons requires numerous personnel and dedicated facilities. Training time, the most precious resource available to a corps commander, often focused on nuclear duties and responsibilities versus conventional tasks. Smart weapons generally do

not require a separate infrastructure and training, while demanding, builds skills usable in actual conflict.

Smart weapons are not inexpensive. The TOMAHAWK missiles, used so effectively in the gulf, cost approximately one million dollars each.[84] Based on figures provided in Aviation Week and Space Technology each HELLFIRE costs approximately $41,100, the MAVERICK $102,978, and the HARM $241,993.[85] Smart weapons must be available in adequate quantities to support combat operations. The following comment points out the hidden dangers of smart weapons technology.

> Still, the Air Force's habit of forgoing $50,000 smart bombs so it can buy more $50 million airplanes may yet prove a mistake. Stocks of laser - and television - guided bombs may be rapidly depleted in the first few days of Operation Desert Storm, forcing reliance on unguided, "dumb" bombs thereafter.[86]

While this prediction did not come true, the warning is clear, particularly with the reduction in tactical nuclear weapons availability.

Collateral Damage

Nuclear weapon use will likely cause extensive collateral and environmental damage. The basic weapon effects of blast, thermal, and radiation injure personnel and damage materiel without regard to combatant status. Nuclear weapon effects are not discrete and may lead to long-term military and

political problems. Many of the targeting issues associated with tactical nuclear weapons deal with identification of high-payoff targets within the collateral damage constraints established by the commander.

Smart weapons, in theory, produce no significant collateral damage. Their high accuracy generally allows the employment of a warhead which disables the intended target without dispensing munitions throughout a given area. Collateral damage from smart weapons employment would most often arise from operator error, software or hardware failure, or targeting error. They can prove especially effective in environments operating under strict rules of engagement (ROE).

Threat

Tactical nuclear weapons would appear to have their greatest military utility in a mid to high-intensity battlefield environment. Short of using nuclear weapons to make a political statement, they would appear to have minimal utility in low-intensity conflict. Using the FM 100-5 and FM 100-15 targeting criteria earlier discussed, nuclear weapons best support a corps commander when faced with lucrative, massed targets which, if attacked, will provide significant tactical advantages. The dispersed battlefield encountered in the low

intensity environment, with the resulting lack of massed targets, would tend to mitigate the potential of tactical nuclear weapons.

Smart weapons appear useful throughout the spectrum of conflict. They can be used to attack discrete targets effectively in crowded urban areas, such as Baghdad, or even specific windows in a guerilla held building. The second echelons of Soviet and Soviet surrogate forces may be effectively interdicted given adequate numbers of smart weapons combined with timely targeting intelligence.

Our remaining tactical nuclear weapons capability, consisting of approximately 700 gravity bombs in Europe, plus additional stockpiles within CONUS appears adequate to support corps operations under normal conditions. While the corps commander no longer controls an organic nuclear capability he can still request tactical nuclear weapons through appropriate command channels.

Reliability

Tactical nuclear weapons, once introduced into a theater of operations, are defeated through destruction of the delivery systems or nuclear munitions themselves. Soviet forces have traditionally placed a high priority on locating and destroying nuclear delivery systems. The dispersal and redundancy of nuclear delivery systems, air and

ground, complicated the Soviet targeting problem. A nuclear weapon, once launched, cannot be defeated.

Smart weapons can theoretically be defeated up until the moment of target impact. While smart weapons pose a significant threat to potential enemies, effective military counters may exist through use of countermeasures or operations and tactics.[87] A study conducted for the DNA stated,

> ACMs [smart weapons] not only lack the destructive potential and long-term effective capability of nuclear weapons, but are also highly susceptible to a wide range of operational and environmental factors. ACM [smart weapons] dependence on accurate, timely, and high-precision RSTA [Reconnaissance, Surveillance and Target Acquisition] assets is another major performance limitation.[88]

Smart weapons must maintain a qualitative edge over potential enemy countermeasures.

Nuclear Threshold

Since 1967, the official NATO policy of "flexible response" placed increased emphasis on conventional deterrence. Though political, military, and moral inhibitions would reduce the inclination to employ tactical nuclear weapons, their very existence created a dangerous temptation. Is it not possible that the availability of tactical nuclear weapons could rush the employment decision process, particularly for a corps in a tenuous defensive posture? Therefore, even with a credible conventional capability, it's doubtful the nuclear employment threshold is lowered.

Smart weapons, combined with the removal of Army nuclear weapons, raise the nuclear threshold. A corps, equipped with smart weapons, will be expected to maximize all conventional capabilities before requesting nuclear allocations from higher headquarters. Smart weapons increase the warfighting capability of a corps in all environments. Hopefully, this distances the Army away from the probability of employing tactical nuclear weapons.

CONCLUSIONS AND IMPLICATIONS

Our next war will be fought without Army nuclear weapons. Even though never employed, Army tactical nuclear weapons provided a tremendous firepower capability for a corps commander. No other weapon offered as much battlefield potential for the Army yet created so many seemingly unsolvable military, political, and moral problems for the United States and her allies which precluded its use. Regardless of their actual warfighting usefulness and the Army's doctrinal approach, nuclear weapons certainly played a key role within NATO through the end of the Cold War.

Tactical nuclear weapons matured in a world dominated by mutual suspicion and distrust between the two superpowers. The relaxation of tensions between the East and West hastened the demise of tactical nuclear weapons. Politically the costs of tactical nuclear weapons outweighed the benefits.

Today's smart weapons are good and getting better. Their demonstrated effectiveness and increasing potential provide a corps commander capabilities only dreamed of a decade ago. Given the nature of today's threat, even one equipped with nuclear weapons, and the sophisticated technology available within a corps, smart weapons have precluded the need for Army nuclear weapons.

With any decision, a certain amount of risk is involved. Smart weapons were never intended to replace nuclear weapons, a concept reinforced by numerous studies conducted for the DNA. Smart weapons effectiveness is directly dependent upon their continued availability in sufficient quantities. Congressional and/or Department of Defense (DOD) decisions to reduce either smart weapons research and development efforts (R&D) or fielded systems would have a negative impact on a corps ability to fight.

The decisions have been made. The Army's job is not to dwell in the past, but look to the future and continue to improve. The continued development and fielding of smart weapons will enable the non-nuclear Army to provide substantial firepower in any combat environment. While tactical nuclear weapons were perhaps considered weapons of last resort, smart weapons can be weapons of first resort.

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